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NOTES ON THE FAUNA OF THE COUNTRY OF THE CHESS AND GADE.

By T. E. LONES, M.A., LL.D., B.Sc.

(Continued from vol. xviii., p. 461.)

SEVERAL species of bdelloid Rotifers from the country of the Chess and Gade have already been dealt with, and a few others will now be described. The identification of species of bdelloid is more difficult, as a general rule, than that of other species of Rotifers. Further, among the bdelloid Rotifers, I have found most difficulty with species of the genus *Callidina*, but I have examined many specimens sufficiently to satisfy me that they belonged to Gosse's *C. bidens*, and also many specimens which could apparently be none other than Gosse's *C. bihamata*. Another bdelloid Rotifer which will be described is *Adineta vaga*, Davis.

39. *Callidina bidens*, Gosse.—All the specimens so far examined were from moss, and the best and most numerous were obtained on November 3rd, 1912, from moss growing in the lane leading from Abbot's Langley to Upper Highway, and from a much more luxuriant growth of moss near the western end of the lane from Dudswell to Champneys on September 30th, 1913. During the examination of these Rotifers, their movements were so rapid that they seemed to glide over the surface of the glass. Occasionally they drew in their long oral ends, expanded their wheels, and swam through the water, and their wheels were kept expanded when the Rotifers anchored themselves to the slide. Their bodies were somewhat slender and spindle-shaped, and,

except for the brown contents of the stomach, were nearly colourless. No eye-spots were seen, and, it may be stated, importance is attached to this negative character in defining the genus *Callidina*, although it is an admittedly unsatisfactory one. The foot was comparatively short, and the spurs were small, curved, and pointed.

40. *Callidina bihamata*, Gosse.—This Rotifer was found in large numbers in moss from Hyde Lane, near Leverstock Green, on December 19th, 1912, and in the luxuriant growth of moss, previously referred to, near the western end of the lane from Dudswell to Champneys, on September 30th, 1913. In the specimens examined, the trunk was longitudinally ribbed, somewhat swollen, and quite distinct from the head and foot. A very conspicuous feature was the presence at the oral end of two crossed hooks on a short frontal column, and another feature was the dorsal antenna situated at a comparatively great distance from the oral extremity of the Rotifer. No eye-spots were seen. One of the specimens was measured, and found to be about $\frac{1}{80}$ -inch long. The movements of these Rotifers were rapid, the bdelloid progression being effected with great smartness, and the Rotifers usually extending themselves to their full length; this bdelloid movement often passed into a rapid gliding one.

41. *Adineta vaga*, Davis.—In a luxuriant growth of moss, on the Bucks side of Shire Lane, between Cholesbury and Hastoe, several specimens of this remarkable Rotifer were obtained on October 16th, 1913. They were about $\frac{1}{40}$ -inch long. The foot was abruptly separated from the trunk. Two very divergent hooks projected from the oral extremity, and no eye-spot was seen. The head was flattened and its ventral surface was furred; by means of this furred surface the Rotifers moved along the slide. Some of the specimens were seen to anchor and then extend themselves to their full length over the surface of the slide, then rapidly draw back, and then repeat these movements in a different direction, the foot being kept anchored at the same spot on the slide. After repeating these movements until most of the area around the point of anchorage had been covered, the Rotifers moved to fresh positions, where they anchored again and repeated the movements just described.



These peculiar movements, when once seen, can be easily recognized again; and, as far as I know, are characteristic of Rotifers of the genus *Adineta*.

42. *Polyarthra platyptera*, Ehren.—It has already been stated that a distinguishing feature of the rotiferan fauna of Chipperfield Common Pool is its unusually large number of so-called "Skipping Rotifers." At any season of the year, specimens of these can be obtained there. The commonest is *Triarthra longiseta*; a second less common species is *Pedetes saltator*; a third species, *Polyarthra platyptera*, occurs in the pool, but seems to be much rarer, for only one unmistakable specimen of this species has so far been obtained, and that specimen was dead. The oral end of the Rotifer was truncated, and the posterior end was rounded. The width of the body was rather more than half its length. There were two clusters of broad, serrated spines, one cluster springing from the right and the other from the left side of the oral end of the body. Only eight spines were counted, and as this species has twelve spines altogether, the other four had evidently been broken off or decayed. The longest spines were half as long again as the body of the Rotifer, and the innermost pair were symmetrically placed, one on each side, and met at their extremities so as to form with the front part of the Rotifer a triangular figure. This single specimen of the species was obtained on April 13th, 1914, together with a few specimens of *Anuræa brevispina*, the rotiferan fauna of the pool on that date being very poor.

43. *Notommata lacinulata*, Ehren.—This very small Rotifer has been found in small numbers in many localities of the country of the Chess and Gade. The form of the Rotifer is shown in Fig. 19, drawn from a specimen obtained from Parsonage Farm Pool, Abbot's Langley, on April 11th, 1914. This specimen was measured and found to be about $\frac{1}{200}$ -inch long. The greater part of the body was occupied by the stomach, which was filled with a large quantity of food material of a brown colour. This Rotifer often anchored itself to the slide with its

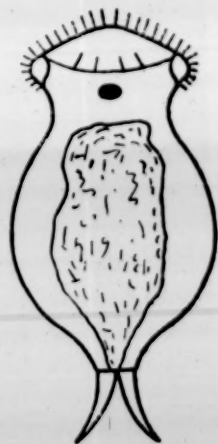


Fig. 19.

toes wide apart, and remained thus anchored for several minutes at a time; in fact, when it was desired to set it free from the slide, it was usually necessary to give it a gentle push with a dissecting needle. There was no vegetable matter on the slide among which the Rotifer could burrow, and, after a few short rapid movements, it usually anchored itself again. Considering the small size of this Rotifer, the water currents set up by it towards its mastax were very powerful.

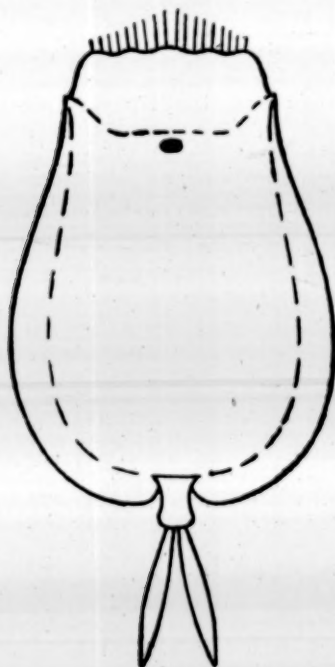


Fig. 20.

44. *Euchlanis dilatata*, Ehren.—This beautiful Rotifer has been found in King's Langley Lodge Pool and in some of the temporarily disused watercress beds near Cassiobury Park, Watford. The largest number was obtained on April 13th, 1914, from the aforesaid pool. They were very active, alternately swimming about and burrowing amongst the small amount of vegetable matter on the slide. Sometimes they anchored themselves by their feet and turned upwards so as to show their bodies in end view; the appearance thus presented was approximately a segment of a circle with recessed edges. In dorsal view, Fig. 20, the lorica was of oval form, passing into a truncated

oral part; the peripheral parts of the lorica were very clear and transparent. A cervical, bright red eye-spot was very conspicuous. The dorsal gap of the oral part of the lorica was but imperfectly seen, the Rotifer's head never being sufficiently retracted to expose it. The rounded notch of the dorsal plate was visible, and from it projected a rather short, jointed foot carrying two blade-like toes. No setæ were detected on the foot. The length of the Rotifer was about $\frac{1}{10}$ -inch.

The forty-four species so far described in these notes represent much of what I have done on the Rotifera of the country of the Chess and Gade. With the exception of a few of them, e. g. *Æcistes stygis* and *Brachionus quadratus*, they are Rotifers which any collector may find with the exercise of a little patience, and are fairly representative of the rotiferan fauna of the district. There are other species already found, notably *Philodina roseola*, *Cælopus porcellus*, and *Anuræa curvicornis*, on which my rough notes are not sufficiently full. I hoped to be able to continue collecting specimens of these and other species, but since August last my opportunities of collecting have been very few.

A great deal depends on chance when collecting forms of life of any kind, and, in this connection, one of the most interesting phenomena in the distribution of Rotifers is the sudden appearance of numerous specimens where for some time before only a few specimens of a species have been obtained. Several instances of this kind have been given in the preceding notes, e. g. the enormous numbers of *Brachionus rubens* in a pool near Potten End, and of *Brachionus pala* at Coxpond, and the large numbers of *Pterodina patina* in Langleybury Pool, of *Anuræa brevispina* in Hastoe Pool, and of *Eretmia cubeutes* and *Noteus quadricornis* in Parsonage Farm Pool, Abbot's Langley. Another instance, relating not to the Rotifera but to the Protozoa, is sufficiently interesting to deserve mention. On many occasions I had obtained a few specimens of *Bursaria truncatella*, Ehren., from the pool at Chipperfield Common. On December 30th, 1912, however, a calm, fairly fine day, with the temperature of the air 46° F., and that of the water of the pool 44·5° F., I obtained hundreds of the above-mentioned Protozoa in every water sample taken. Nothing like this was seen by me before

the date mentioned, nor has it been seen since, either in the pool at Chipperfield Common or in any other pool.

The study of the periodical changes in the relative numbers of forms of life which, like *Synchaeta pectinata*, may always be found in one and the same pool, and the study of the appearances and disappearances of forms of life which, like *Noteus quadricornis*, seem to appear only at certain seasons, offer an interesting field of inquiry for naturalists who are able to devote sufficient time to them. Even small pools, like those of Chipperfield Common, Parsonage Farm, Langleybury, and Cholesbury Common, present, as my rough notes amply show, great and varied changes of their inhabitants, both in species and numbers of specimens.

The remarks just made relate to the changes in the fauna of one and the same pool. There is another field of inquiry which seems to be at least as interesting. This relates to the remarkable differences between the faunas of pools in the same comparatively small area. These differences are most strikingly shown when the rotiferan fauna of a pool like that of Chipperfield Common is compared with that of Langleybury Pool, or with that of the Berkhamsted Castle Moats. In these cases, however, the conditions of life are quite different, there being but small quantities of aquatic plants in Chipperfield Common Pool, while Langleybury Pool and the Berkhamsted Castle Moats are normally very weedy; there are also other important differences. It is easy to understand why, in these cases, the rotiferan faunas should be different in a marked degree. What are certainly more perplexing, and perhaps more interesting, are the questions which arise when a comparison is made between the rotiferan faunas of pools in which the conditions of life seem to be more comparable. Take e. g. Langleybury and Parsonage Farm Pools, and the moats of Berkhamsted Castle. All these are shallow, their waters are usually quite clear, their beds are covered by comparatively thick deposits of fine mud, and they contain large quantities of aquatic plants; further, all three are old, and, as far as I know, have not been disturbed for years. A comparison of their rotiferan faunas, based on the preceding notes, shows that several species, viz. *Metopidia solidus*, *Pterodina patina*, and *Salpina mucronata*, are found in all three. These species are

usually found in clear water containing plenty of duckweed, and this plant is very plentiful in both the pools mentioned, and there is a large quantity in the moats. This explains, in no small degree, the aforesaid agreement between the rotiferan faunas.

It is by no means easy, however, to explain the differences in the rotiferan faunas, which differences can be seen best from the following table :—

Species.	Langleybury Pool.	Parsonage Farm Pool.	Berkhamsted Castle Moats.
<i>Colurus caudatus</i>			×
<i>Diglena biraphis</i>	×		
<i>Diplaz trigona</i>	×		
<i>Eretmia cubeutes</i>		×	
<i>Floscularia campanulata</i>			×
<i>F. coronetta</i>			×
<i>Metopidia acuminata</i>	×		
<i>M. lepadella</i>			×
<i>M. oxysternum</i>			×
<i>Noteus quadricornis</i>		×	
<i>Notommata lacinulata</i>		×	
<i>Cecistes stygis</i>		×	
<i>Philodina citrina</i>	×		
<i>Pterodina valvata</i>	×		
<i>Rattulus rattus</i>		×	
<i>Rotifer macrurus</i>	×		
<i>Stephanops lamellaris</i>			×

Further collections might very well show that some of the above species are common to two or all of the above-mentioned waters. The table, however, represents the results obtained from a large number of water samples collected at all seasons of the year and during a period of nearly three years. It may be, therefore, that the differences between the rotiferan faunas of the pools of Langleybury and Parsonage Farm and the Castle Moats are quite as great as the preceding table indicates.

There are several differences between the pools mentioned and the moats. In the first place, they are at different elevations, Parsonage Farm Pool being about 200 ft. higher than Langleybury Pool and 100 ft. higher than the moats. Again,

they differ very much in the degree to which they are exposed to sun and wind. To what extent these differences influence the rotiferan faunas it is very difficult to say, but there are other differences which undoubtedly influence the faunas to a great extent. So far I have not made a detailed examination of these differences. It may be stated, however, that the flora of the moats is much more varied than the floras of the pools, and, while the waters of Langleybury Pool and the moats are modified by the products of decomposition of vast numbers of leaves fallen from trees and shrubs of various kinds which border them, the water of Parsonage Farm Pool contains small quantities of sodium chloride and other salts derived from surface drainage.

When such differences have been examined in detail, a consideration of them in relation to the differences in the rotiferan faunas will probably suggest a maze of perplexing questions, but if attempts to solve these lead to no definite results, there will remain a number of statements of fact which might be of interest to other observers. For the present, however, further consideration of the rotiferan fauna of the country of the Chess and Gade will be deferred, and the next series of notes will deal with the Entomostraca.

A DIARY OF ORNITHOLOGICAL OBSERVATION MADE IN ICELAND DURING JUNE AND JULY, 1912.

BY EDMUND SELOUS.

(Continued from p. 66.)

June 24th.—A minute or two before 6.30 a.m. the female bird is on the nest. I do not know how long before that. Just afterwards I hear the cry of the male, and at 6.30, when I get to the entrance of the tent, again, the nest (except for the chicks) is empty. Before 6.35 the bird returns and makes a little rejoicing flight about the home-rock, ere alighting on the ledge. She appears then to be carrying nothing, but the instant she alights I see that she holds a mass of flesh in her left claw. She then feeds the chicks, and, at 6.40, broods them. Before doing so, however, and whilst not yet in her accustomed position, with reference to the chicks, upon the nest, she goes through those peculiar movements which I have so often before observed her to make, hunching up her back, bending down the head and tail, and making some sharp and, as it were, spasmodic motions with the latter, that is to say with all that part of the body to which the word tail might be applied, not the rectrices only. These movements, therefore, can stand in no special relation either to the eggs or young, but have to be explained independently of either. The fragmentary nature of what the bird this time brought back to the nest was clearly apparent. It looked as though she had clawed out the whole of the contents of the visceral cavity, and gripped them together in a bunch. The long intestinal canal was the most apparent portion. It hung down in several places—I suppose in loops, but I could see one free end. I have before, during the feeding of the chicks, noticed its whiteness, but did not so much remark it this time. Were the young always fed in this way it would account for there being no remains of such repasts in the nest, for in another

long and careful examination, yesterday, I could detect none, either there or on the ledge. I have, however, plainly seen the viscera being picked out of its containing framework, as also what must, I think, have been a whole dead bird. Yet I have never seen the bird take anything away with her from the nest nor are the excreta ejected from it in defæcation.

7.40.—Bird flies to opposite side of gorge, and preens herself on a small rock or stone, but in less than a minute flies back and continues to do so on the nest. At a minute or two past 8 she goes off, again, and flies down the slope above the opposite side of the ravine. In her descent she skims gradually nearer the ground, and, over the brow of one of its sinuosities, makes a dip at something which might be a brown stone and then flies on. The glasses discover the brown object to be the male Merlin. To assure myself of this, I have to lose sight of the female, but she shortly flies up from another point on the slope, and passes me, not appearing to carry anything. As soon as she perches, however, on the brow of the gorge, facing her nest, I see something considerable in one of her claws, and with this, the next moment, she flies to the nest. As before, it appears to be a ball or bundle of the viscera, and again she holds it in the left claw. The feeding takes six minutes, and, at the end of it, she broods the chicks. She certainly seems now really to cover them, spreading out her pectoral feathers widely around them, and drooping her wings. When flying, this last time, she, as before, bent up her shanks so that what she carried was not distinctly discernible amidst the feathers into which it was pressed. At 9.12 she goes off again and flies to a point on the downward slope of the mountain—the usual direction in which she goes. I there get the glasses on her, and when she flies up again, which is almost immediately, follow her with them right on to the male Merlin, at another point lower down, for she comes into sharp contact with him, causing him to make a little pitch forward, and, grabbing eagerly at something, flies on a little further with it, and then again goes down. It is all so quick that it is difficult to take in every detail, but the grab must have been at something, over and, probably, on which the male stood. He must have been surprised, for a moment, as she came up from behind, but no doubt instantly understood and

surrendered it. I could not pick the female up, again, with the glasses after she had alighted, but she soon flew up and was back at the nest at 9.14, with another lump of entrails, with which she fed the chicks.

At about 10.5 a.m. the female goes off the nest and flies to a promontory of the ravine side opposite her home-rock, and there preens herself very thoroughly for some minutes. She then flies further down the slope of the mountain, and such a speck is she, amidst the waste of moss and vast *débris* of lava fragments, that I cannot find her with the glasses, and, something having intervened, I only see her again at the nest, and feeding the chicks, at 10.14. There was no sign of the male, this last time, either by sight or sound. This does not, of course, prove that he had not flown in with booty, as on other occasions, but it hardly seems likely that the female would have preened herself in such a leisurely way before flying to him, had he been the occasion of her leaving the nest. I have established it that she does not always take what is brought in to her at once to the nest, but leaves it, or part of it, on the ground, should it be more than she has present need of, for future occasions. I think it very likely therefore that she, this time, procured something thus left or deposited. She did not, however, go down amongst the black rocks, where she yesterday left something that the male had brought.

At 10.55 the bird goes off the nest and I take a walk, returning and finding her still away (though I cannot, of course, tell how the interim has been occupied) in about an hour's time. She returns and takes her place, again, not bringing anything with her, at 11.25. At 11.32 she is off again, and at 11.40 I catch sight of the pair *in coitu*. The act was accompanied with the only different cry from that so often noted, which I have yet heard—a sharp, shrill monosyllabic utterance of no fulness or power, differing considerably from what I find it convenient to call the twitter, which is made up of a succession of little squeaks, but equally indicative of vocal poverty. The exigencies of the tent stop all further observation till 12.30 p.m., when I find the female bird on the nest. The sexual activities of these Merlins are thus seen in force, even in the midst of family cares; and although it must be now quite unnecessary, or even impracti-

cable, they seem to be attended with some disposition to build a nest.

At 12.50 p.m. the female quits the nest and flies to the ravine's edge, where, sitting on a rock, she alternately preens herself and stretches, for nearly ten minutes, then flies over the hill-side to a rock so far away, that, though I follow her on to it, she becomes then almost invisible—I just see her go up from it again and then lose both rock and bird. At 1.15, however, she comes flying back to near where she had before perched, and here she again sets to preening herself. She brings nothing with her and I surmise that her excursion has been an amatory one. After a while she goes up and flies from one place to another in the neighbourhood of her home, settling and preening herself, perhaps, a dozen of times before, at 1.41, she, at last, takes her place on the nest again. The chicks have thus been left for fifty minutes, in which time their mother might easily, one would imagine, have caught something for them, had she wished to, but she has returned without anything. It would appear, therefore, that, as with the Peregrine,* the division of labour, in the care of the young, has become so confirmed in this species that it can no longer be broken through—perhaps, however, I should only say that this seems probable.

Just after the bird takes her place, it comes on to rain, and it is not till it is clearing, though still raining, that she goes off again. As the flaps of the tent are now closed, except for a narrow aperture, I have to follow her flight with my unaided eyes, which, however, stand me in good stead, for I see her, when far down the slope, make the little dip down, and, at the same time, get an indication of the other bird. As before, having taken her rations, she flies on and I see her again alight, a good way beyond where she received them, but here she becomes indistinguishable from the brown stones about her. Her return to the ledge is preceded by a visit of the male to it, who, however, alights only for a moment, on the ledge, and

* 'The Peregrine Falcon at the Eyrie,' by Frances Heatherley, p. 63. Mr. F. H. Edmondson, writing in the 'Naturalist' for February, says, "Both kill, though the male mostly, the female only once." This is an interesting approximation to my own experience. A process of differentiation is evidently proceeding, which would admit of individual differences.

then flies to the other side of the gorge, where he stands perched. At 2.37 the female flies in and feeds the chicks, which takes her about four minutes. She then broods them, but at 2.55, or thereabouts, leaves the nest again, returning in two or three minutes, when she gives them a second meal which takes nearly twice as long. This last exit of the female took place when my eyes were closed for a moment or two, but when I opened them the male is still perched where he was before; it looks as though the hen had only brought a portion of what she received, and gone off for more.

I forgot to note that, some little time before this, whilst she was brooding the chicks, the female bird walked along the ledge, as on a former occasion, but, this time, right to the end of it, and began picking the green grass there with great spirit. It looked as though she were eating it, and though this may seem very unlikely, I certainly thought I saw her swallow a blade or two. Whatever she really did, when she had done it she made her funny little run back along the ledge to her chicks, and I then left her and made an ascent of the mountain, the characteristic features of which, with the lake in what is now probably part of an extinct crater at its top, I have already described. I return at 6.30, to find the female bird on the ledge, by the nest, and she shortly broods the chicks. About 7 p.m. the male bird flies up the gorge with his usual cry. The female flies out, but not to him, and there is no meeting either in the air or when he, shortly afterwards, perches on a favourite promontory. She flies on and returns, unladen, at three or four minutes past 7. At 8.13 she leaves the nest and flies briskly about, for a little, before again taking her place at 8.20. She seems impatient for the coming of the male, and when, a little past 8.30, he flies in, with his twitter, she darts off, to join him and is back with booty, and feeds the chicks at 8.35.

June 25th.—Owing to my oversleeping myself—which was owing to my lying recumbent rather than sleeping, for the greater part of the night, on account of my feet keeping cold and the ground hard, even through two Icelandic feather beds—I could make no observations this morning, other than that the female bird was on the nest, before Sigurdsson's arrival with the ponies ended this monograph and ushered in the return journey.

"Which-ee, which-ee, which-ee, which-ee, which-ee, which-ee, which-ee-which" or "Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit"—one of the two, or between the two, and so on, at intervals of from five to ten minutes, perhaps. It is the cry of the Whimbrel when actuated by some definite idea, not always clearly apparent. Beware of forming a theory that the bird, as it walks, saying this, says it only at the top of each little tussocky hillock with which the sopped ground is quite dotted, for, if you do, it will fail you sooner or later, and the cry go up from the valley, this or that one being skipped and passed unmelodiously over. Still, speaking generally, these Whimbrels seem to like thus to pipe from the vantage, as it were, of one of the low eminences they so constantly move amongst. This particular one I am watching, now, at length becomes stationary, thus posted, and for ten minutes or a quarter of an hour, perhaps, or even longer, continues perseveringly with its witless, monotonous, yet ever pleasing little "Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit." Then, at length, from somewhere in the nearer middle distance, comes a "tor, tor," as though fraught with warning and—to a quick response of "Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit"—another Whimbrel rises on the wing. The first at once follows suit, like brown shadows the two come flitting to each other, and from both together goes up, now, the "Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit." Then they wheel away from each other. One goes down some way off, and is silent, the other—surely the one I have first had under observation—flies back, sinks shadow-like, walks, with precise little steps to his old or some close-adjoining hillock, mounts it, and goes on with his "Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit." It would seem now that there ought to come another grave "tor, tor" (or has the danger been averted?), but there never does, nor any other note or cry—not even the classic one—from the late-appearing bird, at least whilst I have the patience to wait. But the other stands ever on his hillock, and still, at moderate intervals, says, "Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit."

(To be continued.)

A CATALOGUE OF THE LAND AND FRESHWATER MOLLUSCA OF SUSSEX.

By E. W. SWANTON.

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Haslemere.)

A PAPER under the above title by J. E. Harting, F.Z.S.,* was published in the 'Zoologist' in the spring of 1878. Ninety-four species were enumerated, but no allusion was made to varieties. The sources of information at Mr. Harting's disposal included William Borrer's MS. List of Sussex Land and Freshwater Mollusca, Weaver's account as given in Gordon's 'History of Harting,' and W. C. Unwin's "List of Lewes Mollusca," which appeared in the 'Naturalist' in 1853.

During the past thirty-seven years our knowledge of the molluscan fauna of the county has increased very considerably. Numerous papers and notes have appeared from time to time in various scientific periodicals, including the 'Journal of Conchology,' which published William Jeffery's authenticated list of the Land and Freshwater Mollusca of Western Sussex (1882), J. H. A. Jenner's paper concerning East Sussex species (1891), and East Sussex records by William Whitwell (1900-1903).

If we include post-Tertiary forms now extinct in Britain, some thirty species have been added to the Sussex list since the appearance of Mr. Harting's paper, and about one hundred and sixty varieties have been recorded. The need of a revised and extended catalogue is thus very evident. By way of introduction to the same, some comments may be given upon certain points of special interest.

NEW SPECIES.

Of recent additions to the British list of inland Mollusca, *Helicella heripensis*, *Planorbis vorticulus*, and *Valvata macrostoma* have been found in Sussex. It may be noted, though, concerning

* Editor of the 'Zoologist' at that time.

this trio, that, failing anatomical differences, they are probably only varieties of well-known species. *Helicella heripensis* is apparently very near to the variety *gigaxii* of *H. caperata*; *Planorbis vorticulus* is perhaps an almost keel-less form of *P. vortex* (it had been recorded from Pleistocene deposits in the county some years before it was discovered in the living state); and *Valvata macrostoma* is still considered by some authorities to be identical with the variety *depressa* of *V. piscinalis*.

LUSITANIAN ELEMENTS.

Animals and plants which are supposed to have reached Britain from the Continent by land connection to the south-west of Ireland in Miocene times constitute the so-called Lusitanian element of our fauna and flora. Dr. Scharff remarks that though we have a good many species of Lusitanian origin in the British Isles, yet "we have only a mere remnant of what we ought to have, had the climate been less trying. . . . That the Lusitanian fauna is very ancient in the British Islands is proved by the fact of the discontinuous distribution of so many species. A greater number survived in Ireland than in England." *

In Sussex the Lusitanian elements of our molluscan fauna include *Helicodonta obvoluta*, which still lurks in the recesses of the primeval woodland tracts on the slopes of the Downs and in ancient parks; *Helicella cartusiana*, another downland species occurring in isolated colonies; and *Hygromia fusca*, a woodland species of great rarity. There are indications that these elements are waning. Dead shells of *Helicodonta obvoluta* occur in spots where repeated search has failed to yield the living animal. *Helicella barbara* (= *Helix acuta*) at one time flourished at Mill Gap, Easebourne, but is now extinct there. Three specimens of *Helix pisana* from the collection of the late Frederick Townsend, F.L.S. (now in the Haslemere Museum), are said to have been found in Sussex about the middle of the past century; further evidence of the existence of this species in the county is very desirable. Precise information concerning the distribution of *Helicella cartusiana* is needed; the records appear to indicate that it is dwindling.

* 'History of the European Fauna,' p. 307.

Testacella is a Lusitanian genus represented in Sussex by two species—*T. haliotideae* and *T. scutulum*; but as in both the records appear to be in connection with cultivated ground, they may possibly be modern introductions. The latter was brought to Chichester thirty-four years ago.

METHODS OF DISPERSAL.

The molluscan fauna of the so-called "dew ponds" on the South Downs has been investigated by Mr. Clement Reid, who contributed, in 1892, a most interesting paper "On the Natural History of Isolated Ponds" to the fifth volume of the 'Transactions of the Norfolk and Norwich Natural History Society.'

These ponds are depressions puddled with clay, and used by farmers as water reservoirs; they are maintained by mist, fog, and rain, the dew supply being quite inconsiderable. They usually teem with animal life. Mr. Reid observes that "they are distant two or three miles from the nearest stream or marsh; and as the Downs rise to 800 ft., and the average height is fully 200 ft. above the highest streams, it follows that any aquatic animals or plants found in the ponds must have been transported uphill, as well as across uncongenial tracts of dry grass." *Limnæa pereger* is of common occurrence in these ponds. In the summer of 1891 the writer noted that the pond near Chanctonbury Ring was teeming with them.

Mr. Reid alludes to "Red Lion Pond on the open Down, three miles south-east of Lewes; height 540 ft. above the sea, and 530 ft. above the marshes of the Ouse; nearest water, the marshes of the Ouse, distant seven furlongs." In June, 1890, he observed *L. pereger* in it. He also remarks that in a "small pond by the side of the high road, half a mile west of Christ Church, Stansted (near the Hampshire border), height 312 ft. above the sea, and 220 ft. above the nearest stream," he noted *L. pereger* and *Planorbis spirorbis* on September 25th, 1891. Other species occurring in "dew ponds" are *Limnæa truncatula*, *L. stagnalis*, *Planorbis vortex*, *Physa fontinalis*, *Pisidium pusillum* (occasionally), and *Sphærium corneum*.

The ancestors of these Molluscs were in all probability carried up to the ponds on the feet of birds, or on large water insects. Mr. Chapman records in the 'Field' (1884) that he shot a Snipe

at Rye with a *Sphærium corneum* fastened to the hind toe. He noted that the bird was sailing "with apparently a leg down." The foot and shell were placed in the British Museum. Numerous records from other counties of transmission of water Molluscs by birds may be found in Mr. Wallis Kew's 'Dispersal of Shells.'

Land Molluscs may be carried from place to place by similar agencies: witness a comparatively recent observation in Sussex. Mr. H. J. Stalley records in the 'Journal of Conchology' (April, 1911) having found in a lane near Upper Beeding "a huge Bumble-bee with one of its hind legs held firmly between the shell and the operculum of a fine specimen of *Cyclostoma elegans*; the Bee was only able to progress in a series of short flights, rising about two feet in the air, and then being dragged down again by the weight of the Snail, reaching the ground in each case some four or five feet from its last resting place."

Man has played and will continue to play no insignificant part in the dispersal of Molluscs. Probably in the majority of English counties enthusiastic conchologists have brought living Snails from considerable distances and turned them down in spots where they had not previously been observed.

Testacella scutulum was introduced by Mr. W. Jeffery in 1881 into his garden at Ratham, Chichester, from Newport, Isle of Wight. Specimens were collected from the garden in June, 1889, and probably it continues to flourish there.

Weaver, writing of *H. pomatia* in Gordon's 'History of Harting,' remarks that "a tender solicitude for the length of our catalogue of natural productions has induced us to import some fifty or sixty specimens of this fine Snail into the parish. These were obtained from Preston Candover, where about thirty years ago they were plentiful, and we made an impartial distribution of them between Padswood Copse, the Warren, the hedge-rows on either side of Love Lane, and Lever's Copse at the foot of the Fore Down; but the experiment to establish them here signally failed; we never saw one of them afterwards." Weaver attributes their extermination to Hedgehogs.

Mr. W. Jeffery unsuccessfully attempted to introduce (*circa* 1868) this species into his garden and adjacent bank at Ratham, near Chichester.

The Rev. W. A. Shaw turned down some Northamptonshire

specimens of *H. pomatia* in a chalk-pit on the Downs near Kingley Vale in September, 1909, but has not visited the spot since.

Instances of the introduction in ballast of Molluscs into certain districts in Sussex during the construction of a railway are quoted by Mr. Wallis Kew (*op. cit.*, pp. 197-198):—" *Helix virgata* found plentifully on embankments between Pevensy and Bexhill, where the London, Brighton and South Coast Railway runs close to the sea, was probably brought, as the Rev. S. Spencer Pearce states, with the chalk forming the embankments, which is believed to have come from the Eastbourne cutting, some eight or nine miles away; the same Snail, according to another observer, noticed in several places on railway banks, also in Sussex, 'was probably brought with chalk'; a colony of *H. cartusiana*, also, known to have existed for some years at Cowfold, in the same county, and now extinct, is believed to have been originally introduced with chalk. *H. virgata* . . . established in gardens now disused and weed-grown, around some of the Martello Towers in the midst of the broad shingle beach, which, of course, is destitute of terrestrial Molluscs, between Eastbourne and Hastings, was probably introduced, Mr. Pearce suggests, with the chalky soil of which the little plats were formed, or it may have been carried thither with garden plants."

ASSOCIATION WITH LOCAL ARCHÆOLOGICAL REMAINS.

Mr. Herbert Toms, in a paper entitled "Rough Notes on Land and Marine Shells associated with Local Archæological Remains," read before the Brighton and Hove Archæological Club in April, 1912, raises the interesting question whether *H. nemoralis* was eaten by prehistoric peoples. He had noticed large numbers of bleached shells associated with Roman and British pottery in the mole-heaps covering the tops, slopes, and bases of ancient cultivation balks near Brighton, on spots that are now devoid of furze, and had ascertained subsequently that Lt.-Colonel Pitt Rivers had noted similar shells in excavations at Cissbury, Caburn, and Seaford Camps. I am indebted to Mr. Toms for detailed notes concerning the shells observed at these camps, and here append a summary of them.

A section had been cut through the ditch and rampart at Cissbury, and during the cleaning out of the ditch Pitt Rivers found that it had been dug through the filled-in shafts of several of the old Neolithic mines. In the filled-in ditch he noted shells of Oysters and large Snails in the upper layer, shells of sixteen Oysters, two hundred large Snails, and about two hundred *H. nemoralis* in the second layer, and a number of shells of Oysters and *Cyclostoma elegans* in the third layer. Near the bottom of one of the filled-in Neolithic shafts a skeleton was found, together with a lot of animal bones mixed with quantities of shells of *Helix nemoralis*. (It would be interesting to know if these shells were bored.)

In the early British pits and camp on Mount Caburn, near Glynde, Oyster shells were present in the surface mould of the pits, but in no case was a single Oyster shell or a shell of *H. aspersa* found in the filling-in at the bottom; but shells of *H. nemoralis* were found in great abundance all through the pits, and in one of them a layer occurred just below the turf. Quantities of *H. nemoralis* shells were found near the bottom of the entrenchment ditch, and in some pits they were associated in considerable numbers with those of Oysters, Periwinkles, and Cockles, also bones of various domestic animals.

At Seaford Camp (pre-Roman) Pitt Rivers noted quantities of Oyster and Limpet shells in the mould capping the ditch, but not lower. Two feet below the surface a Whelk shell was found in association with a considerable number of shells of *H. nemoralis* and *H. hortensis*.

Shells of *H. nemoralis* and *H. hortensis* have been found by Messrs. J. R. Mortimer, H. Toms, and others in connection with ancient encampments in other parts of England, but the notes given above are sufficient to indicate the interest that attaches to the question raised by Mr. Toms. The evidence, as it stands at present, rather points to the intrusion, in many cases, of the shells into the pits and ditches by natural agencies. It must be remembered that *H. nemoralis* is a common Mollusc on the Downs, and during the gradual silting-up of the pits and ditches their shells would become intermingled in some numbers with the earth. Their occurrence, however, in such large numbers in the middle layer at Cissbury gives strong support to Mr.

Toms's suggestion, and we must not overlook the fact that *H. nemoralis* is eaten at the present day with much relish in many Continental countries, and in some districts is even considered to have a more delicate flavour than either *H. pomatia* or *H. aspersa*.* It is therefore only reasonable to suppose that this Mollusc was eaten during hard times, if not regularly, by the primitive occupants of the Sussex Downs. Mr. Toms does not claim to have established his point, but there is much to support it, and it merits careful investigation. Since writing the above, the Rev. W. A. Shaw informs me that *H. nemoralis* was found in British middens excavated on Stoke Clump in 1910.

FOLKLORE.

There are two interesting observations by Mr. Weaver mentioned in Gordon's 'History of Harting' that deserve quotation here. On p. 319 he observes that *H. ericetorum* is "the common Snail of our Downs, and is often put in requisition for decorative purposes by our tender-aged rustic beauties, who mount a number of the dead shells as necklaces and bracelets by stringing them together." This appears to be a survival of a very ancient practice, and one would much like to know if bored shells have been found on prehistoric sites in Sussex.

On p. 312 Weaver writes concerning *Arion ater*:—"By many persons of easy belief, this Slug is thought to be endowed with a valuable property, in which may be found a slight compensation for its depredations. In the destruction of warts on the human skin, it has the credit locally of having been eminently successful long before the application of acetic acid to this purpose. The living Slug, after having been carefully rubbed over the parts affected, is to be securely impaled on a thorn in some secluded place and there left to die. If, from the commencement of the experiment, the warts do not gradually become fine by degrees and beautifully less, until they finally disappear, the operator has failed in one or other of the two conditions indispensable to success—implicit faith or strict secrecy!"

(To be continued.)

* Notes on *H. aspersa* in association with archæological remains, and on its use as food at the present time in parts of Wilts and Somerset under the name of "wall-fish," may be seen in my papers on the Mollusca of Wiltshire ('Journal of Conchology,' 1908) and the Mollusca of Somerset ('Somersetshire Arch. and Nat. Hist. Soc. Trans.,' 1911).

CRITICAL NOTES ON SOME STATEMENTS OF
NEWTON ON BIRDS.

BY E. P. BUTTERFIELD.

NEWTON's work is a *magnum opus* indeed, and I am frank enough to confess that such a work, involving such a combination of qualities, could not have been written by any other living man; but whilst recognizing this fact, one can have no hesitation in affirming that the weakest portion is that relating to observations of field naturalists.

Birds differ much in their habits, and what is true of one species in one locality may not be accurate in another, even when such localities are not wide apart, and the observations which I have made below, I am quite willing to admit, may be challenged by the observations relating to other districts; but, whilst admitting this, I cannot help but think that some of the observations of Professor Newton in his monumental work are much too sweeping in their character, and will have to be modified in any future edition.

Newton, after alluding to the male of the Blackcap (*Sylvia atricapilla*) sharing with the female the duty of incubation, refers to writers who have declared that the male whilst so employed has been known to sing—"a statement," the Professor adds, "that seems hardly credible." I do not know on what ground he wishes it to be inferred that he disbelieves the statement, but I am very much mistaken if I have not heard the male sing, not perhaps his best song, but somewhat insouciantly, whilst in the act of incubation.

Cuckoo (*Cuculus canorus*).—Its arrival, Newton says, is at once proclaimed by its song, which is confined to the male sex. Contrary to these statements I have frequently known the Cuckoo after its arrival to be exceedingly reticent, and I have good grounds that, occasionally at least, the female does utter the well-known cry popularly attributed exclusively to the male

sex. The appearance of the Cuckoo, Newton further states, is a signal "for all the small birds of the neighbourhood to be up in its pursuit, just as though it were a Hawk, to which indeed its mode of flight and general appearance give it an undoubted resemblance." In this district and many other districts I have visited, especially in the neighbourhood of vast moorlands, the Cuckoo is not much mobbed nor harried by a great variety of small birds, other than the Titlark, this being the species which is most victimised by the Cuckoo in such districts. I hardly think that small birds mistake the Cuckoo for a Hawk; indeed, their behaviour in the presence of the Cuckoo is altogether different from their behaviour in the presence of a Sparrow-Hawk, and the mode of flight of the latter species is quite unlike the Cuckoo's. When the Titlark is in the presence of the Cuckoo, it evinces more curiosity than fear.

Newton dismisses as a vulgar and seemingly groundless belief the idea that Cuckoos suck the eggs of other kinds of birds, but the accumulated facts in presumption of this habit hardly warrants him in dismissing this subject in such a summary fashion. This habit, however, may be chiefly confined to the female, and to those nests into which it foists one or more of its own eggs. When the Cuckoo introduces its egg into the nest of its dupe, one egg of the fosterer almost always mysteriously disappears; and I have never known the nest in which two eggs of the Cuckoo have been laid to contain the full complement of eggs of the fosterer.

Referring to the Spotted Flycatcher (*Muscicapa grisola*), Newton writes that this species is one of the latest of our migrants, which is quite accurate, but he goes on to say that it seldom reaches these islands before the latter part of May. Even in Yorkshire it not unfrequently arrives at the end of April, and is here usually in full numbers by the middle of May.

Writing of the Pied Flycatcher (*M. atricapilla*), it is said that this species is more numerous in the Lake District than elsewhere in England, but I am not quite so certain whether it is not more numerous in some parts of Yorkshire. Newton does not mention its occurrence in Wales, but in some parts of the Conway Valley I have found it more numerous than in any other part of the British Isles.

The Grouse (*Lagopus scoticus*) is rarely or never found away from the heather on which it chiefly subsists, so says Newton; but in severe winters it is not an unfrequent occurrence to see them at quite a considerable distance from the moors.

It is not at all certain whether the Kestrel is quite such a harmless bird as is to be inferred from Newton's book, though there can be no hesitation in confirmation of the statement that this species is quite the most harmless of all the Accipitres.

Contrary to the statement of Newton, the Sky-Lark (*Alauda arvensis*) is much more partial to grassland than cornfields for breeding purposes, and the statement that it rears several broods in a season is open to question. Five eggs is a clutch which must be rare in this part of Yorkshire; abundant as this bird is—probably the most abundant of British birds—its present status can by no means be assigned to its excessive fecundity.

The Linnet (*Linota cannabina*) can scarcely be said to feed largely, if not especially, on seeds of plants growing on heaths and commons, but chiefly on seeds grown in the more cultivated parts of the country, sometimes far away from its breeding haunts, the dandelion seed perhaps being its most common food; other seeds, such as the plantain, sorrel, knapweed, furnish this bird with a perennial supply throughout the summer months.

Whether the Twite (*L. flavirostris*) replaces this species either partly or wholly may be a moot point, but the breeding haunts of the Twite would seem to be at a much higher altitude. Indeed, the Linnet, other things being similar, seems to affect during the breeding season moderate altitudes.

The Common Sandpiper is said by Newton to arrive in May, but would it not be more accurate to say *April*? The Professor thinks that it hardly exceeds in size a Sky-Lark, but it always strikes me as decidedly larger, but I would not be dogmatic on this point.

The Sand-Martin is said to have several broods in the year, which is contrary to my experience. I should scarcely think that a very large proportion have even two broods in a season. In its departure it is more regular, as Newton says, than other *Hirundinidæ*, and leaves earlier.

The Nightjar (*Caprimulgus europæus*) does not always perch on a tree lengthwise, for sometimes I have seen it perch in the

ordinary way, and in this neighbourhood it nearly always, if not always, lays its beautifully mottled eggs on the bare ground, not generally where the herbage is short, as stated by the Professor. He further adds that the site chosen for the nest one year is almost certain to be occupied the next ; but although this species shows great local attachment in its nesting-site, I have never found the nest in the precise site for two years in succession.

Under the head of Water-Ousel (*Cinclus aquaticus*) it is not at all certain that the Professor's remarks are in accordance with his usual courtesy, when those who think that this species may be guilty of feeding on the spawn of fishes are accused of being careless and ignorant.

Alluding to the habits of the Ring-Ousel (*Turdus torquatus*), it is said that it shuns "woods, groves, and plantations," but I have found its nest twice built in trees in plantations.

A NOTE ON PARASITIC KERONA.

BY THE REV. H. VICTOR-JONES, F.Z.S.

THE psychical life of the Protozoa has always been a puzzle to the biologist. A puzzle because, so often, into the play of life of these microscopic animals there enters an element which controls the action and mode of persisting of each individual organism, and this element defies classification.

The question is still in abeyance as to whether the series of effects constituting the life-history of these lowly organisms is merely and solely a chemical stimulus and a mechanical response, or whether we ought to bring in the incipient germs of "knowing"—of intelligence. Kerworn, after tremendous labour, came to the conclusion that the Protozoa do not show the slightest trace of intelligence. Jennings, too, thinks that their life is a series of "trial and error." But these assumptions are still far from satisfying, and with many noted biologists we concur in the statement "that after all we must not dismiss the possibility that in the possession of these lowliest of the low there may be the slightest vestige of the proto-psychic power of analyzing the causes thrust upon them, and which bring out the decidedly problematic effects constituting the life of the unicellular organism."

The greater number of Protozoa are parasitic, and we can easily understand why many types have, each, their own peculiar and particular type of host, but there are other cases which seem to demand that we stipulate to the parasite a certain amount of control over circumstances. The psychical life of the lower types is as yet so little known that it is, indeed, unwise to dogmatise upon the process of "living" among such as merely the method of "trial and error."

Some twelve months ago, while examining a specimen of *Hydra viridis*, which had been obtained from some duck-weed (*Lemna*) growing in a rather stagnant pond, I was interested to

find that it had fifteen tentacles instead of the usual number possessed by this species, namely, six to ten tentacles. Interest was further aroused by the movements on the surface of the cœlenterate of eleven protozoal parasites. When the high power was brought to bear upon the organisms, it was found that eight were wandering over the outside of the *Hydra*, while three were quite at ease inside the body cavity—apparently wandering aimlessly over the endodermic cells.

The parasites were all of the same species, and were identified as *Kerona polyporum* :—

Description.—Müll., Ehr. Genus of infusoria of the family Oxytrichina.

Characters.—Body covered over with cilia, hooks present, but no styles. Body flat or depressed, whitish, elliptico-reniform with a row of longer cilia in front of the mouth; length approximately 1-144".

These eleven parasites were found on and in *Hydra viridis*, while it is stated by many that the host is confined to the species *H. fusca* and *H. vulgaris*. Thus we see that the limit is too narrow, and that the range stretches over and includes *Hydra viridis* as an occasional host of *Kerona*.

It has also been generally understood that *Kerona* is an ecto-parasite, found only on the outside of *Hydra*, yet here three were in the body cavity. For ten days the *Hydra* and parasites were kept under observation. The ratio during that time still remained the same, eight remaining on the outside and three occupying the cœlomic cavity, all exhibiting the usual apathetic attitude of parasites in general; namely, they were entirely indifferent to movements of the host, wandered at leisure over the surface, living probably by osmotically absorbing the nutriment found in connection with the host. The water in which they were kept during these ten days was well supplied with Entomostraca and other food-supply for the *Hydra*.

One of the *Kerona* divided on the fourth day. Thus the ratio was nine outside and three inside. After the tenth day no food was supplied, and to one's astonishment on the twelfth day many of the external parasites were found to have made their way into the cœlomic cavity; and from this time on, the

parasites were equally at home outside or inside, and simply wandered in and out with ease and safety.

This observation causes us to wonder whether it was the lack of food-supply outside which caused the external parasites to make their way inside the body cavity, where certainly the supply of food juices would be richer. If this suggestion be correct, then the *Kerona* must have at their disposal a "something" which we have no ground for calling "intelligence," but still a "something" which enabled them to become aware that the cœlomic cavity was richer in food material than the outside, and they consequently made their way to the richer grounds.

But if we, on the other hand, rule out this possibility and claim it to be chemiotaxic stimulus, then we are in a quandary as to why this stimulus did not come within the first few days when the difference in strength between the juices inside and outside was as great as it was when the apparent stimulus did come.

Another fact which this observation brings out is this, that *Kerona* must not rigidly be classified as an ecto-parasite; for we have seen that for about fifteen days three of the parasites were endo-parasitic in habit, and entirely immune from the deleterious effects of the gastric ferments which dissolved and killed other organisms stronger and larger than *Kerona*, for example, *Daphnia* and small annulata.

Besides, after the tenth day ecto-parasites became both ecto- and endo- in habit. Therefore *Kerona* must not be classified as rigidly confined to the species *H. vulgaris* and *H. fusca*, nor to the endo-parasitic class alone, but also to the ecto-parasitic.

Moreover, should *Kerona* be classified as a parasite in the true sense? It rather comes under the class of Commensals, where some mutual benefit is derived. Can it be that the *Kerona* has some part in cleansing the *Hydra* from foulness? *Kerona* being almost always found on *Hydra* which inhabit stagnant ponds. If the *Kerona* is to be reckoned as a parasite, why should the *Hydra* not rid itself of the irritating depredator by means of its powerful stinging nematocysts? Instead, the *Kerona* wanders inside and outside, over and around the trigger-hair or cnidocil without causing the nematocyst to shoot out. Neither do the amœboid digestive cells inside envelop the internal ones

in a similar way to that which they do when purely foreign organisms are engulfed.

Has the *Hydra* a spark of intelligence?—or is it mere chemical stimuli?

The first explanation seems high, but the second certainly too low, and here we are compelled to leave the psychical life of the lower organisms and those happenings in their lives which suggest control, and say with Professor Thompson, "that there is no reason why any evolutionist should doubt that they have in them the indefinable rudiments of mind."



Kerona polyporum (parasitic on *Hydra*).

OBSERVATIONS UPON THE BEHAVIOUR OF A
CAPTIVE ROCKLING.

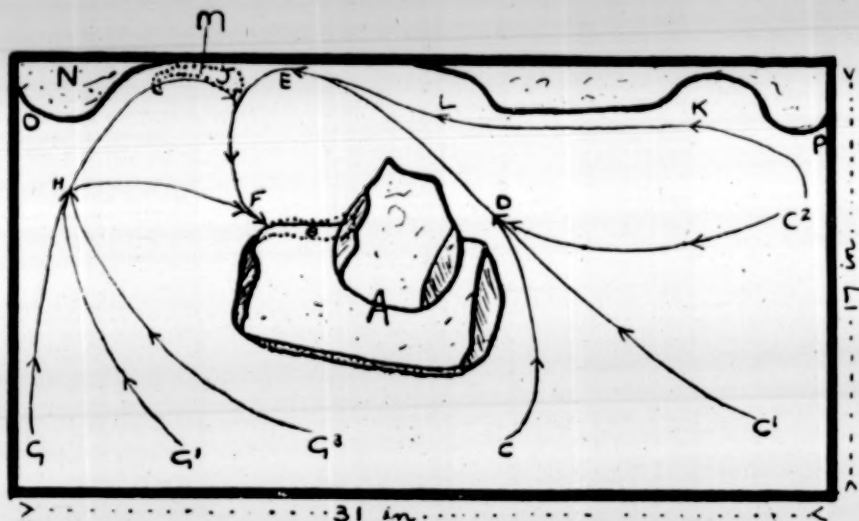
BY H. N. MILLIGAN, F.Z.S.

THE Five-bearded Rockling (*Motella mustela*) which is the subject of this article was obtained by me at Walton-on-the-Naze on December 3rd. I did not watch the movements of the fish with any particular care during the first week or ten days of its residence in an aquarium at the Horniman Museum, and the following remarks must therefore be understood to refer to the time subsequent to the first ten days of its captivity.

A plan of the aquarium in which I placed the Rockling is given in the accompanying figure, the back and two sides of the tank being of dark blue slate and the front of glass. The fish made its resting-place beneath and behind the shelving rock lettered A, which stands nearly in the middle of the floor of the aquarium, in the position shown in dotted outline B. Except when tempted to follow pieces of raw beef (which it will seize and swallow very readily) held close before its snout in wooden feeding-forceps, the Rockling did not seem to care to leave this place in the daytime, and I have only twice seen it do so voluntarily. In the night, however, it wanders freely. I have visited its tank after dark with an electric hand-lamp, whose light I could turn on and off at will, and have observed that the fish searches and researches every part of the aquarium, and that its movements have a vigorous and determined character not displayed in the daytime. I often find in the morning that the pebbles on the bottom of the aquarium have been disturbed in a way which shows that the fish has ploughed through and through them with its heavy body during the night. The average size of the pebbles is about that of a hazel-nut, so that the Rockling must use considerable force in shifting masses of them.

The fish almost invariably lay in its resting-place B with its tail directed towards the left side of the tank. During its first twenty-one weeks in the tank, I can only remember four

occasions on which I saw it lying with its tail directed towards the right. When tempted with a piece of beef to come out, say, to the point C, or C 1, or C 2, it would seize the food, and then swim back past the corner of the rock A, along the course C D E F, indicated approximately by arrows on the plan.



Plan of Aquarium to show the Resting-places and Routes of a Captive Rockling.

From C to D it would not swim quickly, but when it reached the back of the aquarium at about the point E, it would suddenly hasten its movements, and turn and dart with great rapidity along the course E F to its resting-place at B. The point I desire to emphasize is that, if the fish, in returning to its hiding-place, reached a part of the aquarium to the right-hand of the rock A, it would then *usually* take the course C D E, but *always* moved first to E, and then suddenly quickened its movements to pursue the course E F B. When returning from a part towards the left-hand side of the aquarium, say from G, or G 1, or G 2, it would usually take the course along G H J F to B, turning quickly at J to dart through F into its resting-place, though I have seen it occasionally go from H directly through F to B. Sometimes it would pass from the region of C 2 through K L to E.

I am not quite sure how long the Rockling had been in the aquarium before my attention became fixed upon this habit, but probably about three or four weeks. I then repeatedly tempted

the fish with beef to come out, in order that I might watch the course it took in returning home. What is the explanation of this curious behaviour in following a certain course and then changing it and darting suddenly home? Is it merely an idiosyncrasy of this fish, or a characteristic habit of Rocklings in general? Is it, as I am inclined to believe, an instinctive attempt of the Rockling to mislead possible enemies as to the real position of its resting-place? It will be observed, on looking at the plan, that in the region of E the dark slate at the back of the aquarium is not covered with rockwork (though it is covered above the level at which the plan is supposed to be taken). I thought at first that perhaps this nocturnal fish, when it had secured some food, instinctively directed its retreat towards the dark patch, and this idea may have already occurred to the mind of the reader. But this apparent explanation is shown to be wrong, when it is remarked that the aquarium is in a dark place (lighted when necessary by an electric lamp from above), and that the corners O or P would have been as likely to attract such a poor-sighted fish as the Rockling. Again, why should its speed be greater when it was making the turn from E or J than at other times, or why did it not creep round the rock A to reach B, as one would have expected it to do, instead of passing across the open water between D and E?

On March 23rd (*i. e.* about sixteen weeks after introduction of the Rockling) I put several Common Gobies into the aquarium. The largest Goby was about three and a half inches in length, or about half the length of the Rockling. Immediately the Gobies were dropped into the water they darted away into holes and crevices in the rocks, and when one of them dashed into the place where the Rockling lay, the latter seemed so much alarmed that it at once quitted its hiding-place and took up a position (shown in dotted outline at M) at the foot of the vertical rock N at the back of the tank, with its tail slightly curved, and its head directed towards the right and looking somewhat towards its old hiding-place. In this position, or nearly in this position, in which it is much exposed to view and to the attacks of enemies, if there were any in the tank, it remained, lying almost motionless, at least in the daytime, up to May 1st. If it moved at all in the daytime, it was only for an inch or so towards the right and

then back again. It will be observed that the place it had taken is on a part of the old route from H to J. There are places amongst the rocks covering the greater part of the back of the tank in which the Rockling would apparently have been safer than, and not so conspicuous as, it was in the position which it had taken up, though there is no hiding-place which seems so suitable for it as the one it had at first. It still pursued parts of its old courses, say from C to E, or G to J, but I do not think it did so with quite its former confidence. I observed no sign that the Rockling was making fresh courses to M of a kind likely to mislead possible enemies as to the real position of M.

The loss of its first hiding-place had one curious, and somewhat ludicrous, result. When it had seized beef, which I had induced it to follow, the Rockling, for the first few days, would sometimes dart back along one of its old courses to its former resting-place, and then instantly rush out again in terror when its snout touched the Goby in possession. It appears that the lesson learned so thoroughly in sixteen weeks required some few days to unlearn.

On the morning of April 17th I became aware that the Rockling had formed a new habit. When the food of the Gobies, which consists of fragments of raw beef, was dropped into the aquarium, the Gobies began excitedly to dart out of, and into, their hiding-places, and at first the Rockling shrunk timidly against the wall when a Goby dashed past it. The Rockling was fed last, because unsatisfied Gobies were apt to snatch the food from its mouth. The sight of the Rockling is very poor, and food was therefore placed close to its head. On the 17th I noticed that when the Gobies began to scurry about the aquarium the Rockling showed unmistakable signs of interest, and after a moment or two began to swim as though seeking food. Its behaviour at feeding time (then and since) suggested that in the twenty-five days during which the Gobies had shared its aquarium the Rockling had come gradually to associate unwonted activity of the Gobies with the advent of food. By May 1st the Rockling had become so used to the Gobies that it had begun to lie, along with one or two Gobies, in or close to its old resting-place (but with its tail directed often to the right), and to resume its old courses, though not with its former precision.

NOTES AND QUERIES.

A V E S.

Parrot Learning by Experience.—A Yellow-naped Amazon in our possession was climbing on the wire supporting a pendant of five small electric lamps, and bit it through, getting at any rate a fall, and possibly a shock. Since this experience, she will not touch anything in the shape of a cord or string, let alone trust herself on a pendant wire.—W. CROSS (Aldgate).

Sense of Direction in Birds.—In reply to Dr. Dewar's note ('Zoologist,' xix. p. 156), my assumption as to the Polynesian Cuckoo is identical with that of the late Prof. Newton. Of course, the whole difficulty lies in the fact that the young British Cuckoo's *first* journey is *not* a return journey. Until our theories as to the sense of direction in birds can solve this young Cuckoo problem, they afford no assistance to a "nonplussed" student of migration like myself.—RICHARD M. BARRINGTON (Fassaroe, Bray).

Hermaphrodite Fowl.—Some years ago I received a Fowl which, when cleaned, proved to have male organs about the size of kidney beans, besides an ovary with eggs as large as peas. It was forwarded to me already plucked, so I cannot say what the plumage had been like, but noticed it had one leg black and the other white. My foreman saw it as well as myself, and noticed the peculiarity in the sex organs. I have also had Herrings with hard and soft roes.—F. H. BROOKS.

Blackbird's and Robin's Joint Nest.—When the tenant of a cottage here was cutting the ivy on it, he uncovered and removed the nest of a Blackbird, which flew from the nest when the ladder was put up. The nest is an ordinary Blackbird's nest externally, but has an added lining of hair, moss, and decayed vegetable matter, such as a Robin uses. It contained four Blackbird's and two Robin's eggs. One of the former was afterwards broken, and found to be a good deal incubated; the Robin's eggs appeared to me to be fresh. Probably the Robin added the lining during the laying period when the Blackbird was off the nest; but apparently she must have managed to lay her two eggs during the incubation period. And in that case, as she

could not have sat side by side with the Blackbird, she must have watched for an opportunity when the Blackbird was off to feed. The Blackbird was known to be building somewhere in the ivy, but the Robin had not been noticed.—O. V. APLIN (Bloxham, Oxon).

Black-cheeked Love-birds Nesting in Cage.—A pair of Black-cheeked Love-birds (*Agapornis nigrigenis*), kept last autumn in a cage about three feet six inches square in the bird department at Messrs. Gamage's, nested in a cocoanut husk and laid eggs. They did not sit, but as the cage was only about five feet from the floor in such a greatly frequented establishment, the fact of such a nervous species as a Love-bird nesting in public at all seems to me sufficiently notable to be worth recording.—C. T. NEWMARCH.

Return of Summer Migrants to Old Haunts.—On April 29th we saw the first Turtle-Dove, and from its actions there can be no doubt that it is one of the birds which frequented our garden last year. It came at once to a place near the front door, where the waste seed from the bird-cages is thrown out, and in every way behaved like a bird which felt entirely at home. Another has joined it, and both allow one to watch them at about twenty yards' distance. We have watched Turtle-Doves here for over twenty years, and they have often become fairly tame as summer advanced, but these birds in early May are much more like those which come to the garden in July. My daughter, who lives a few miles away, is quite sure that a Cuckoo she heard last year has returned; she has a good ear for music, and at once recognized a curious fault in the second note of the song. For my own part, I feel as sure of the return of these migrants as if they had been "ringed birds recovered."—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds).

"Paget's Pochard" at Kew.—There are at present to be seen on the pond at Kew two drakes like that figured in Stevenson's 'Birds of Norfolk,' vol. iii. pl. iii.; their eyes, however, are distinctly yellow. They are full-winged, and, I hear, were bred here between a male White-eyed and female Common Pochard, thus confirming the origin attributed to this bird by Stevenson and others. A female, almost exactly intermediate between the two species mentioned (which the males are not), appears to be their sister.—F. FINN.

Colour-change in soft parts of Birds of Prey.—I notice that in the Bateleur Eagles (*Helotarsus ecaudatus*) in the Zoo the red of the bare face and the feet, which becomes most intense when the bird is indulging in its curious display and song, with raised but unopened

wings showing the white lining contrasted with the black head and breast—in which position it might well serve as the Prussian Eagle wearing the German colours and howling the “Hymn of Hate”—becomes, on the other hand, much paler when feeding, the face turning yellow and the feet brick-red or even flesh-colour. The sight of food at a distance will cause this change to begin. Similarly I saw in two Caracaras (*Polyborus brasiliensis*), which were from their movements apparently courting, with thrown-back heads and reiterated cries, that the face was yellow, instead of pale red, as it often is in this bird, and was in some quiescent adjoining specimens. In a Pileated Vulture (*Necrosyrtes pileatus*), however, in the Zoo some time back, the bare face, livid fleshy-white ordinarily used to become brilliant rose-pink, contrasting with the bluish eyelids, as the bird hopped about in the scramble at feeding-time. The legs in the last two birds do not change.—F. FINN.

GASTROPODA.

Appetite of Snails for Green Material.—With regard to your correspondent's interesting note on the appetite possessed by her Slugs for green material, it might interest her to know that I have observed the same characteristic in several specimens of *Helix aspersa* kept for observation purposes under the same conditions as those of your correspondent. I had for some time wondered over the appearance of small holes in the green covering; and I received the clue from your correspondent, and watched carefully. The Snails only attack the covering on nights when they have not had their usual amount of food—four cabbage-leaves (young and small). And they certainly do not make such quick work of it as did the Slugs. During the operation, the horny “jaw” seems to play a much greater part than does the actual radula; a fact I think rather curious, as the “jaw” seems actually to be *projected*, and the radula used simply to bring the muslin against it, not for scraping. They take a long time, as I watched one Snail at work for over half-an-hour before he severed a single mesh. I caught one Snail engaged in enlarging a hole already started, and, fearing it would escape, I acted on a foolish impulse and knocked it down; four Snails in succession came up to the hole, thrust their heads out, and seemed to look about them; then, apparently finding it impossible to get their shells out, with an air very humorous, inasmuch as it seemed to express disappointment, they retreated. Those parts of the muslin of which the colour has been altered by the deposit of mucus

are unattacked; this is interesting, as the fact that they can detect coloration seems to indicate a higher sense of sight and less reliance on smell than some authorities allow. It would be very interesting to make similar experiments with other members of the Gastropoda; for example, some of the aquatic Snails accustomed to feeding on Algæ, or even such salt-water species as the common Whelk.—
R. CARDEW.

NOTICES OF NEW BOOKS.

A List of British Birds. Second and Revised Edition. British Ornithologists' Union. London: W. Wesley & Son. 1915. 7s. 6d.

THIS list is a revised edition of that compiled by a Committee of the British Ornithologists' Union in 1883, brought up to date and embodying the numerous additions to the British bird-list which have been made during the last generation; this, of course, renders it indispensable for workers on our birds. A certain number of changes have been made in the scientific names, in conformity with the practice of American and German zoologists, in going back to the tenth edition of Linnæus. Personally, we do not see why British naturalists should follow the lead of either America or Germany (especially the latter!), since neither of these countries has published any work comparable with the British Museum 'Catalogue of Birds,' which is far more important to working naturalists than any edition of Linnæus; the interest of the great Swede's work nowadays is after all historical, not zoological, just like that of Aristotle's. However, several well-known names, though technically inadmissible, have been retained in the present work to avoid confusion, and the references to Saunders's classical Manual and to the British Museum volumes are given as synonyms, so old-fashioned people are still well accommodated.

The derivations of the (more or less) classical scientific names are still given as in the first edition, and it seems to us that the work has here been ill-revised; *Corone*, for instance,

only means "crow" in Greek, not Latin as well, as here stated. We fail, also, to see why Gesner's common-sense derivation of *arquata* in the Curlew's name from *arcus* (bow) should be set aside, as it corresponds so closely with the Greek *νουμήνιος* (new moon) and the Icelandic "nefboginn" (bow-neb) applied to this bird. *Apropos* of changes in names, it must be admitted that it is a good idea to have given the reasons for these, as is here done, in the Appendix which terminates the book; in that which precedes this are given the species which are rejected as British, owing to the evidence being, in the Committee's opinion, insufficient. There are several errors here; it is not true, for instance, that the wild Canary is "imported in large numbers," and of the American birds cited few are ever imported at all; while as to Baer's Pochard, we happen to know that at the time of the occurrence in 1901 the few previously sent over were all safely interned at the Zoo.

Fauna of British India. Mollusca; Freshwater Gastropoda and Pelecypoda. By H. B. PRESTON, F.Z.S. London: Taylor & Francis. 1915.

THE present volume of the 'Fauna,' giving a complete systematic account of the freshwater Mollusca of our Eastern dominions, is a worthy companion to Mr. Gude's, recently reviewed in these pages, on the land Mollusca. The work is naturally only about half the size of the latter, the number of forms to be dealt with being so much smaller. The introduction contains some interesting bionomical notes, in compiling which the author has been, he says, indebted to Mr. B. B. Woodward's book 'The Life of the Mollusca'; but he has some interesting original observations, notably the record of *Limnæa* and *Pisidium* in Tibet at an altitude of 14,500 ft., apparently a record in molluscan life. The difficulty in drawing a line between brackish and freshwater Mollusca is also of interest bionomically, and Mr. Preston has solved it by generally including marine genera, whose members are liable to be forced into freshwater life by such conditions as occur in the Gangetic delta, where pools may become fresh by reason of excessive rainfall or by the silting-up of their saltwater channels.

The Minor Horrors of War. By Dr. A. E. SHIPLEY.
London: Smith, Elder & Co. 1915. 1s. 6d. net.

THIS little book is a reprint of articles originally written in the 'British Medical Journal,' and contains an account of the various parasitic animals affecting the welfare of soldiers in war-time, such as body-vermin and the flour-moth, whose larvæ prey on biscuit; there are also chapters on Leeches, the supply of which has been greatly curtailed by the operations of belligerents over the areas whence these annelids used to be obtained. The book is adequately illustrated, and deserves, on the whole, the wide circulation it has even already had. Dr. Shipley says: "I confess that these articles have been written in a certain spirit of gaiety." We think the humour rather forced.

The Determination of Sex. By L. DONCASTER, Sc.D. Cambridge University Press. 1914. 7s. 6d. net.

THIS popular summary of one of the most fascinating problems in philosophical zoology is clearly written and well illustrated, and though from the size of the book it has been impossible to make it exhaustive, yet a bibliography of half-a-dozen pages is given for the benefit of readers who may wish to pursue the subject further, and there is likewise a useful glossary of technical terms. Dr. Doncaster's aim has been "to discuss all the more important lines of evidence which bear on the problem of sex-determination, and to illustrate each by one or more representative examples." The study of the determination of sex is, he points out, the study of the causes which lead to the production of an individual of one or the other sex. As these causes, when discovered, may not prove controllable by man, it is obvious that we cannot at present determine at our will the sexes of creatures yet to be born, or even predict them. He thinks, however, that the controlling of the sex of offspring, even in man, is not to be regarded as impossible of ultimate realization. Meanwhile, the present book teems with facts of interest, even to those whose acquaintance with the deeper aspects of such problems is limited, and many of the examples are illustrated, such as the extraordinary diversity of the sexes in the Sea-worm *Bonellia*, where the male is like a minute parasite;

the sex-limited *lacticolor* form of the Magpie Moth (*Abraxas grossulariata*), and the very rare gynandromorph variation in birds. The illustration here, a coloured one, forms the frontispiece, and represents a Bullfinch, male on one side and female on the other. The normal specimens contrasted with this, by the way, must be the large Northern Bullfinch, unless the specimen was a dwarf as well as sexually abnormal. With regard to the case of sex-linked characters most known to the world at large, the almost proverbially rare tortoiseshell tom-cat, it is of interest to note that such Cats appear to be generally sterile.

Reptiles and Batrachians. By E. G. BOULENGER, F.Z.S. London and Toronto: J. M. Dent & Sons. 16s. net.

MR. BOULENGER'S position as the Curator of Lower Vertebrates in the Zoological Gardens has given him ample opportunities for observing the classes with which this handsome and fully-illustrated book has to deal, and what he has to say is put plainly and scientifically, without any of the striving after effect which is rather repellent in so many popular books. There are also a good many original observations, but on the whole there is not so much evidence of the author's professional opportunities as we could have wished, and the book cannot be compared, from a bionomical point of view, with some other standard volumes which have been published on the same groups. Some of the omissions in the work are really serious; thus, in the general account of the Batrachia, nothing is said about the absence of claws in all of them except the Newt *Onychodactylus* and the Anuran genera *Xenopus* and *Gampsosteonyx*, in the latter of which the claws are unique among vertebrates in being the bony ends of the phalanges themselves, not horny epidermal sheaths. The account of *Xenopus* does scant justice to this most interesting amphibian; the fact that the adult will eat dead food such as chopped meat is not mentioned, nor is anything said of a far more remarkable peculiarities of the Tadpole, the remarkable transparency which enables the brain and body-viscera to be plainly seen in the living animal. Yet this remarkable creature bred about twenty years ago in the Zoo collection.

